Dietary Interventions to Improve Respiratory Health in Low-Income Populations

BREATHE CENTER
BRIDGING RESEARCH, LUNG HEALTH & THE ENVIRONMENT

CURE COPD Center

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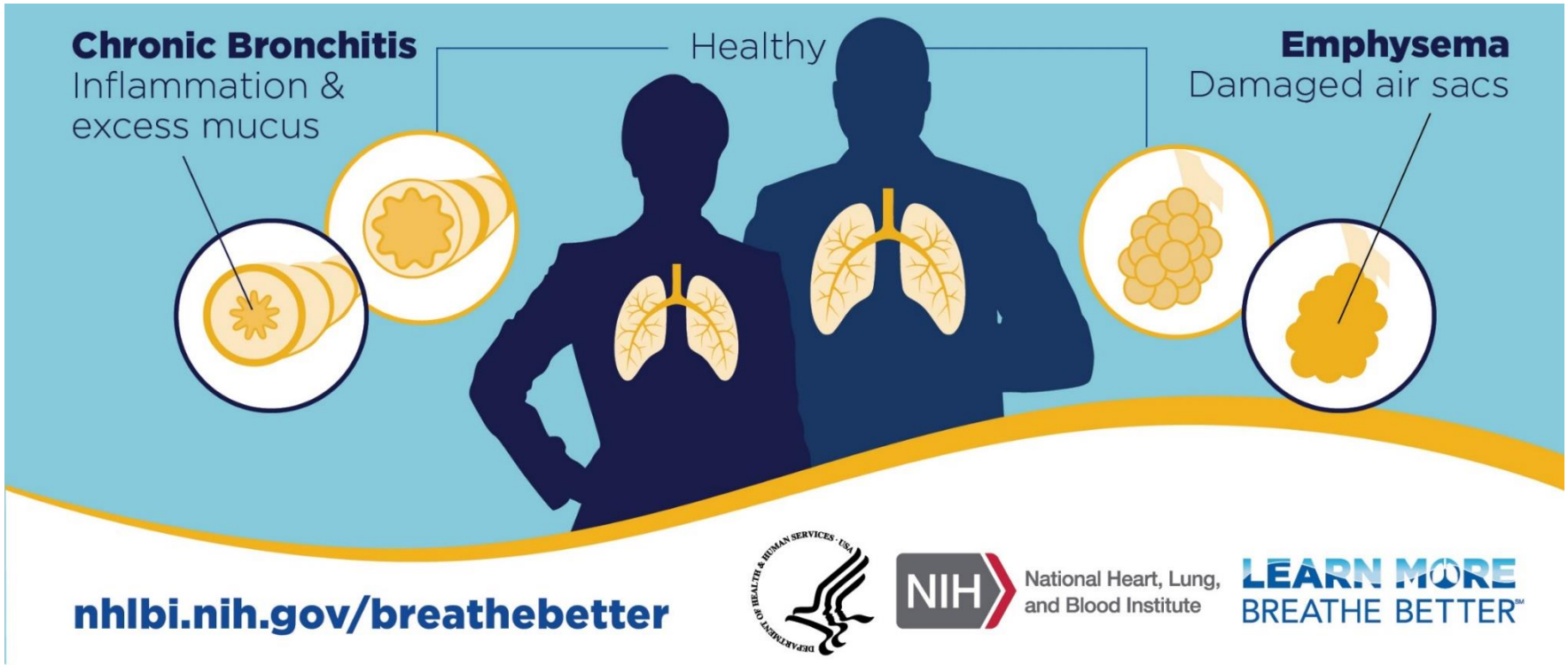
Disclosures

- CURE Funding
  - National Institute on Minority Health and Health Disparities
  - Environmental Protection Agency
- K23
  - National Institute of Environmental Health Sciences

Discussion Goals:

- Chronic Obstructive Pulmonary Disease
  - A Top Priority
  - Multiple Exposures, Multiple Solutions
- Poverty: Disproportionate Risks
- Potential of Diet
  - Why/How
  - Evidence
  - Translational Opportunity

COPD



https://www.nih.gov/news-events/news-releases/lung-development-may-explain-why-some-non-smokers-get-copd-some-heavy-smokers-do-not

COPD Economic Disparities

- National Health Interview Survey (2012-2015)
  - Data linkage to U.S. Census' American Community Survey and National Center for Health Statistics Urban-Rural Classification Scheme
- "Poor community" defined as census tract with ≥20% of households living below poverty line

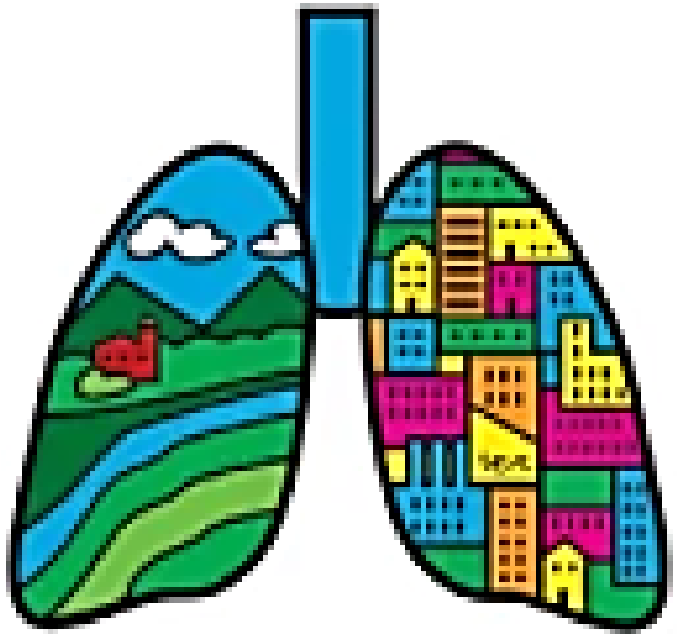
Raju et al, AJRCCM 2019

Poverty = independent risk factor for COPD

Urban/Rural Exposures

RURAL

- Tobacco
- Agriculture
- Livestock
- Mining
- Indoor Air



URBAN

- Tobacco
- Traffic
- Construction
- Industry
- Indoor Air

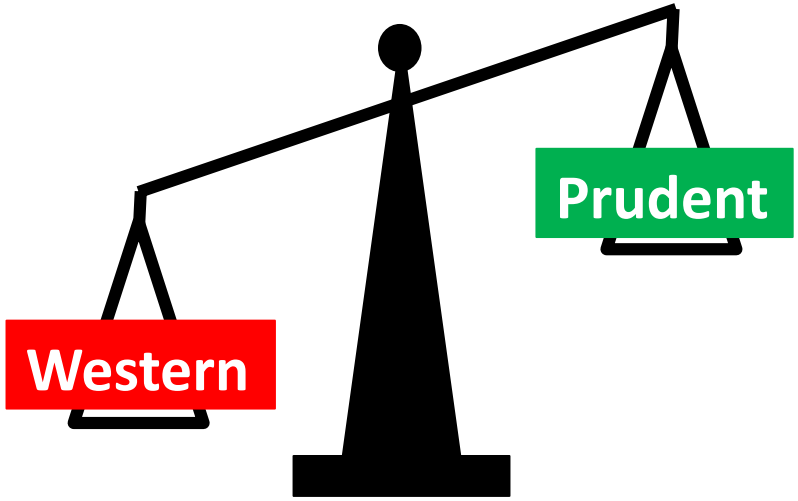
- **People experiencing poverty** – More than 15.8 million people with incomes meeting the federal poverty definition live in counties that received an F for at least one pollutant. Nearly 2.8 million

American Lung Association.

Hendrix et al., J Rural Health, 2010

https://www.lung.org/research/sota/key-findings/people-at-risk

Dietary Exposures



↑↑↑ INTAKE

- processed foods (refined grains, meats, “fast foods”)
- high fat foods, omega-6 fatty acids
- sugar-enriched desserts and drinks

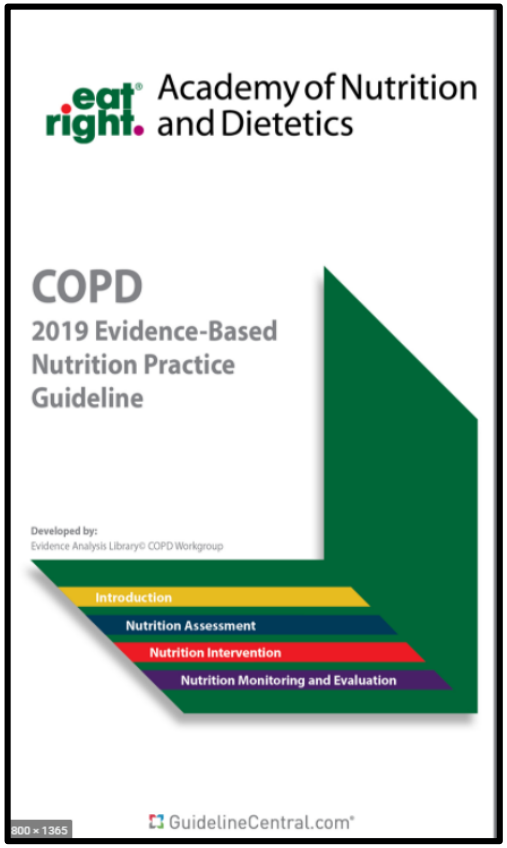
↓↓↓ INTAKE

- whole grains, poultry, fruits and vegetables
- low fat foods, omega-3 fatty acids, antioxidants

USDHHS, Health People 2020
USDA-NHANES: https://fns-prod.azureedge.net/sites/default/files/NHANES-FSP.pdf

Kolahdooz et al, J Am Coll Nutr 2016.
Wang et al, J Am Diet Assoc 2010.

Diet and Respiratory Health



1. **Evidence**
   - Largely observational
2. **Plausibility**
   - Inflammatory/oxidant properties
   - Microbiome: common mucosal response

Scodditi et al, Nutrients, 2019.
Berthon and Wood, Nutrients, 2015.
Brigham et al, Ann All Asthma Immunol, 2015.

ARIC The **Atherosclerosis Risk in Communities Study (ARIC)**

- cohort study in four U.S. communities
- designed to investigate etiology and natural history of atherosclerosis and its clinical manifestations

Visit 1: 1987-1989 (n=15,792)

Western Diet Pattern

Food Item	Factor Loading
Red meat	0.545
Processed meat	0.522
French fries	0.424
Eggs	0.388
Soda/ fruit drink	0.266

Prudent Diet Pattern

Food Item	Factor Loading
Cruciferous vegetables	0.554
Carotenoid vegetables	0.511
Other vegetables	0.508
Fruit	0.470
Dark-leaf vegetables	0.427

Brigham et al, Annals of ATS 2018

Dietary pattern associates with COPD and respiratory health

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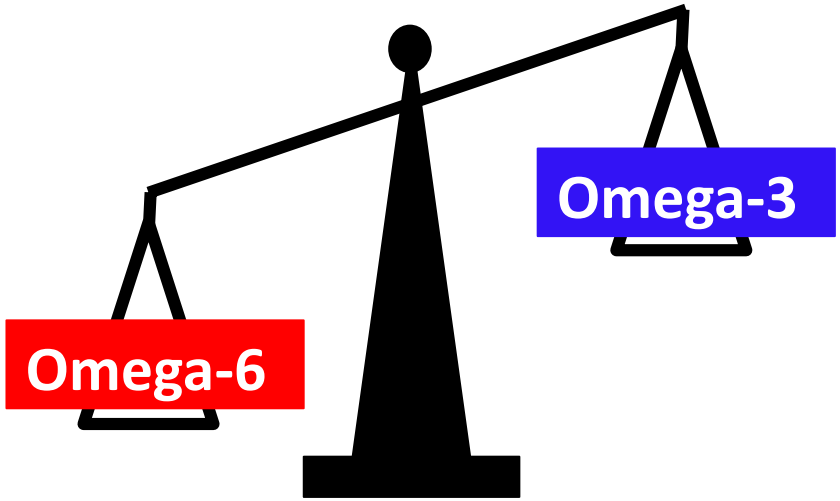
ARIC The Atherosclerosis Risk in Communities Study (ARIC)

- Greater adherence to a Western diet associated with higher prevalence of COPD, higher odds of reported cough, wheeze, phlegm
- Greater adherence to a Prudent diet associated with lower prevalence of COPD, lower odds of reported cough

Brigham et al, Annals of ATS 2018

Omega Fatty Acids



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- high fat foods, **omega-6 fatty acids**
- sugar-enriched desserts and drinks

↓↓↓ INTAKE

- whole grains, poultry, fruits and vegetables
- low fat foods, **omega-3 fatty acids**, antioxidants

Kolahdooz et al, J Am Coll Nutr 2016.
Wang et al, J Am Diet Assoc 2010.

Omega Fatty Acids

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…give rise to lipid-derived mediators of inflammation

OMEGA-6	OMEGA-3
• Leukotrienes • Prostaglandins • Lipoxins	• Protectins • Resolvins • Maresins

Titos and Claria, Prostaglandins Other Lipid Mediat 2013.

Omega FFA intake associates with respiratory health in COPD

(~80% low-income neighborhoods, Baltimore City)

Lemoine et al, Annals of ATS, 2020

- Cross sectional analysis of n=112 participants with COPD
  - Inclusion criteria: age 40 years or older, post-bronchodilator FEV_1/FVC <70% and FEV_1 % predicted <80%, former smokers
  - Exclusion criteria: chronic oral corticosteroid use, other chronic lung disease except asthma, or lack of nutritional data, **homes with particulate matter concentrations < 10 mcg/m^3**

Higher omega-3 intake associated with fewer symptoms, better overall health/perceived well-being, lower predicted probability of severe exacerbation

~80% low-income neighborhoods, Baltimore City

COPD Severity	
FEV_1% pred, mean (SD)	54 (17)
mMRC≥2, %	50%
Exacerbation, %	23%
Income (11% refused)	
<$20K/year	35%
<$40K/year	62%
FFA, median (IQR)	
Omega-3	0.2 g/d (0.2 g/d)

Food	EPA+DHA
Salmon (3 oz)	1.8 g
Herring (3 oz)	1.7 g
Sardines (3 oz)	1.2 g
Trout (3 oz)	0.8 g
Chicken (3 oz)	0.03 g
Egg	0.03 g

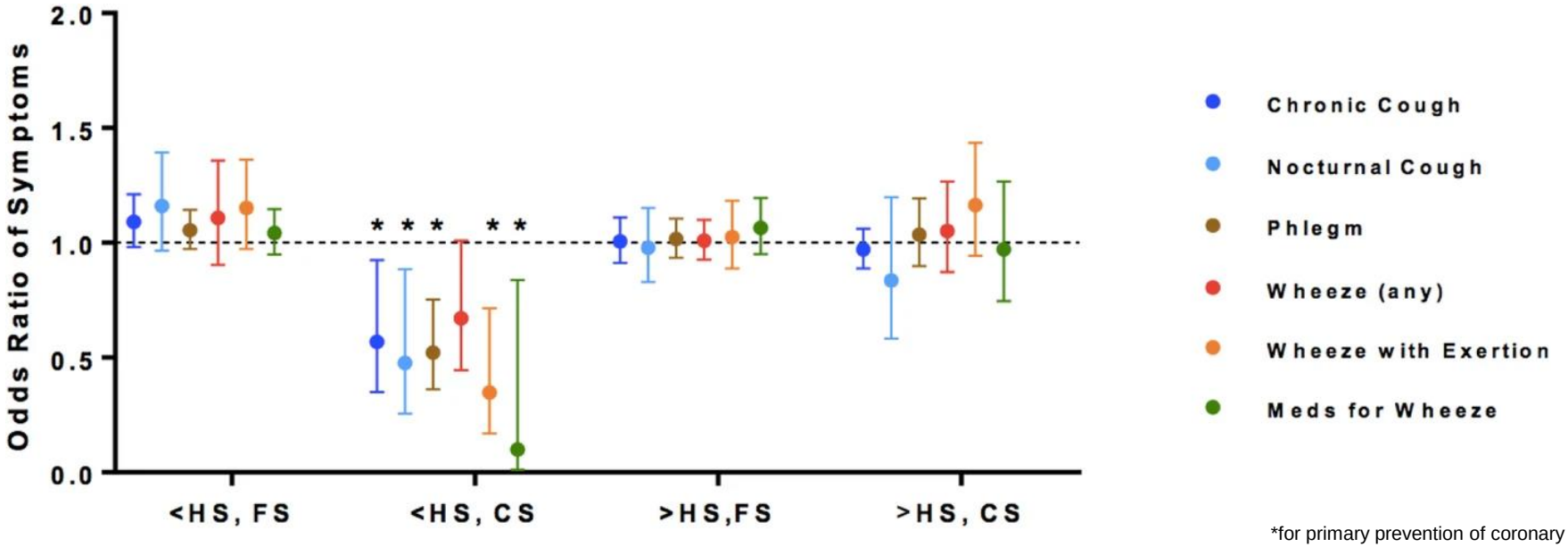
Recommended Daily Intake*: >0.5 g/d

*for primary prevention of coronary heart disease, note variability in recommendation by society
(Kris-Etherton et al, Prostaglandins, Leukotrienes and Essential Fatty acids, 2009)

Lemoine et al, Annals of ATS, 2020
IOM. Dietary reference intakes. National Academic Press; 2005
Kris-Etherton and Innis, J Am Diet Assoc. 2007
https://ods.od.nih.gov/factsheets/Omega3FattyAcids-HealthProfessional/

Relationship between Omega-3 Intake and Respiratory Symptoms is Modified by SES and Smoking Status

(U.S. Adults with COPD)



FFA, median (IQR)	
EPA + DHA	0.1 g/d (0.2 g/d)

*for primary prevention of coronary heart disease, note variability in recommendation by society
(Kris-Etherton et al, Prostaglandins, Leukotrienes and Essential Fatty acids, 2009)

Recommended Daily Intake* >0.5 g/d

IOM. Dietary reference intakes. National Academic Press; 2005

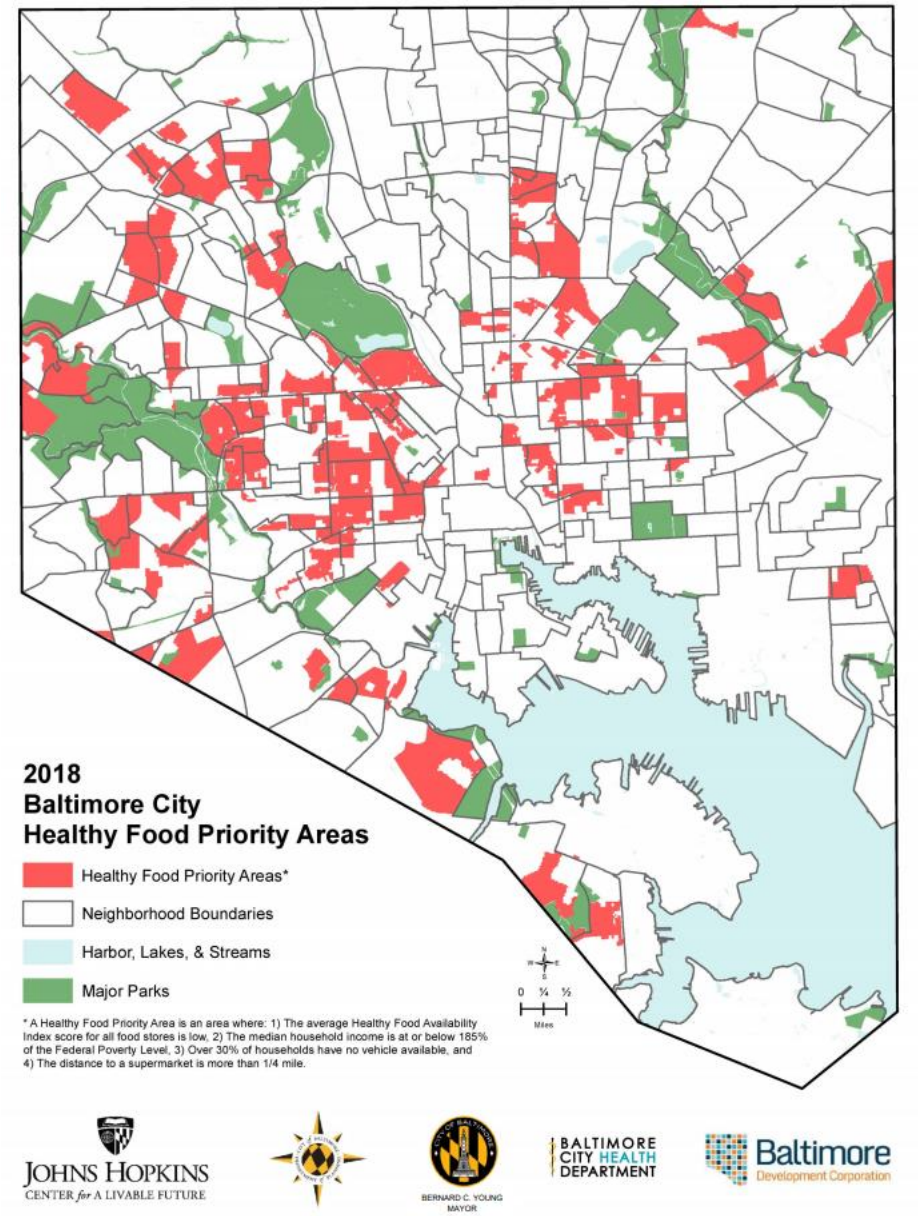
Lemoine and Brigham et al, BMC Pulm Medicine, 2019
Kris-Etherton and Innis, J Am Diet Assoc. 2007

High Pollutant Levels and Low Omega-3 Intake are Synergistic

(Baltimore City)

**Further Preliminary Data in a Baltimore City population with COPD (unpublished)

Steps in Translation: Food Access



Food Priority Area

1. The distance to a supermarket or supermarket alternative is >1/4 mile
2. Median household income is at or below 185% of the federal poverty level
3. Over 30% of household have no vehicle available
4. The Average Health Food Availability Index for all food stored is low

- **Consider food delivery services!**

Dietary Intervention: Increasing Omega-3 Intake

****Pilot**

Eligibility: Moderate-severe COPD, <500mg/day EPA+DHA by FFQ

Intervention (x4 weeks):
$50 voucher, weekly dietary counseling to assist with ordering of omega-3 rich foods and to advise on food preparation

Control (x4 weeks):
$50 voucher, weekly assistance to order food of their preference

Supporting…

The OMEGA-COPD Trial

Aiming to investigate whether a dietary intervention aimed at increasing omega-3 intake among low-income populations with COPD can improve respiratory health.

Thank you!

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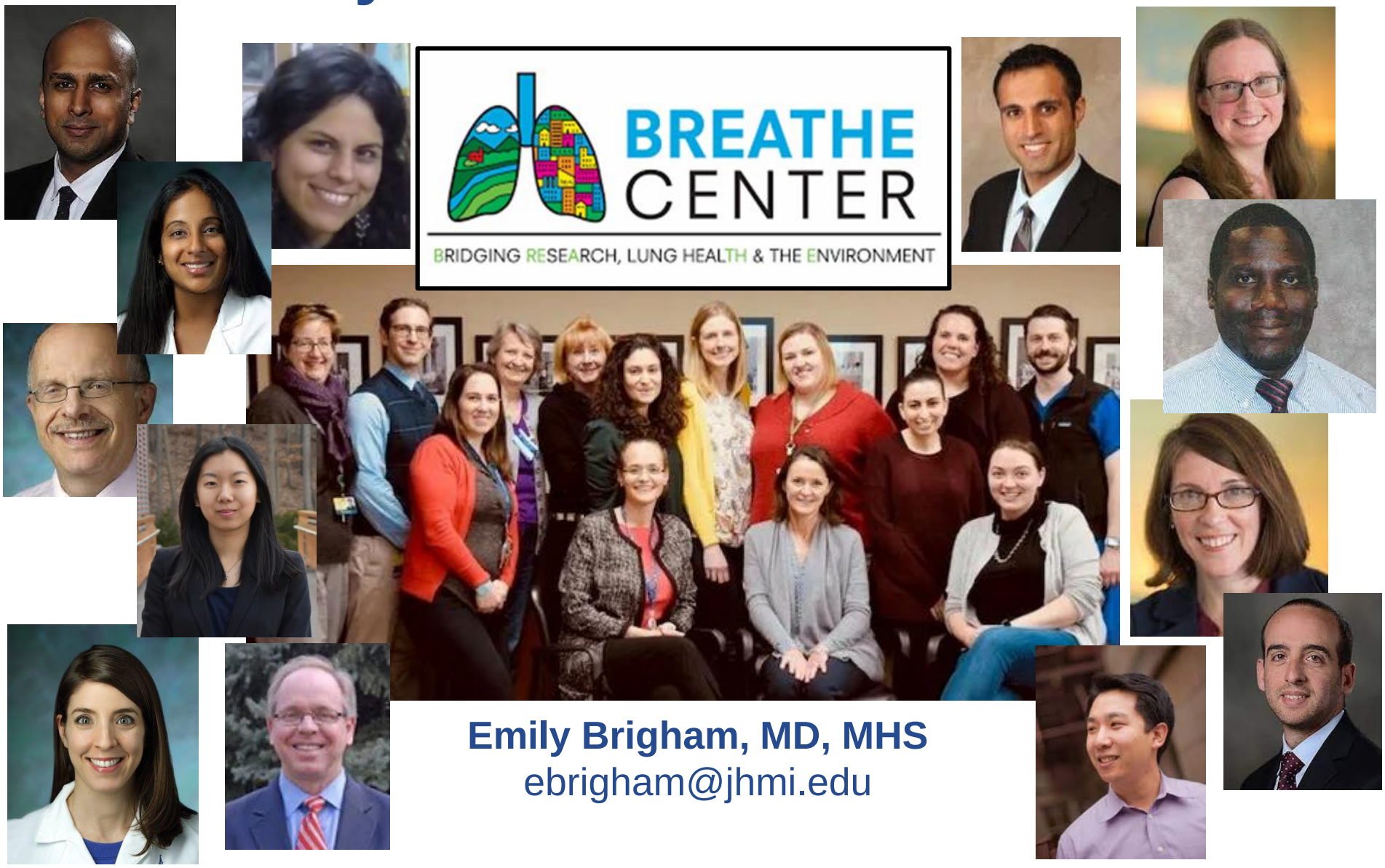

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